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The Imperial Council of Agricultural Research

PE-GROWING IN BALUCHISTAN

BY

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Agricultural Officer in Baluchistan

AND

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INTRODUCTION

IN India, Baluchistan occupies a unique position for the cultivation of grapes. These are grown to a certain extent in the North-West Frontier Province, Kashmir, Punjab and Bombay province, but nowhere is the climate so well-suited for their cultivation as in the uplands of Baluchistan. Grapes of the Deccan have been dealt with by Kanetkar [1906] and Gandhi [1928] and those of Peshawar by Brown [1911], but except for a mere reference by Watt [1893] and Buller [1907], little information is available about the grapes of Baluchistan, the premier grape-growing province of India. A brief note on the grapes of Baluchistan is presented in this paper which, it is hoped, will be of general interest.

Geographically, Baluchistan is situated between $24^{\circ}54'$ — $32^{\circ}40'$ N. latitude and $60^{\circ}56'$ — $70^{\circ}15'$ E. longitude but viticulture is mainly confined to the uplands of Baluchistan which roughly embrace the area covered by $29^{\circ}34'$ to $32^{\circ}00'$ north and $66^{\circ}17'$ to $70^{\circ}00'$ east, i.e. the districts of Quetta-Pishin, Loralai, Zhob, Harnai sub-division and part of Sarawan. Kalat and Panjgur are other localities outside this zone where grapes are cultivated. Taking into consideration the height from mean sea-level, we find that grapes thrive best from 4,500 to 6,000 ft. elevation in Baluchistan. This demarcation of the viticultural zone, however, should not be taken too strictly, as grape-vines are highly adaptable and can be successfully grown in a variety of climate and soil conditions.

The climate of Quetta may be taken as more or less representative of grape-growing tract of Baluchistan which is very dry, and humidity sometimes goes down to 7 per cent in summer. Rainfall (snowfall inclusive) ranges from 8 to 12 in. per annum and is mainly confined to dormant season. There is little, if any, rainfall during fruiting season. Fig. 2 shows relative rainfall and its distribution during the years 1934-37 and part of the year 1938.

In winter, minimum temperature goes down to several degrees below zero (12° F. has been recorded) while summers are fairly hot, when the maximum temperature may approach 100° F. The range between day and night temperature is very wide. Late frosts in early spring are common in the Quetta valley and take a heavy toll of fruit crops every year. Maximum and minimum temperatures for the year 1937 are presented in Fig. 3.

GRAPE-GROWING IN BALUCHISTAN

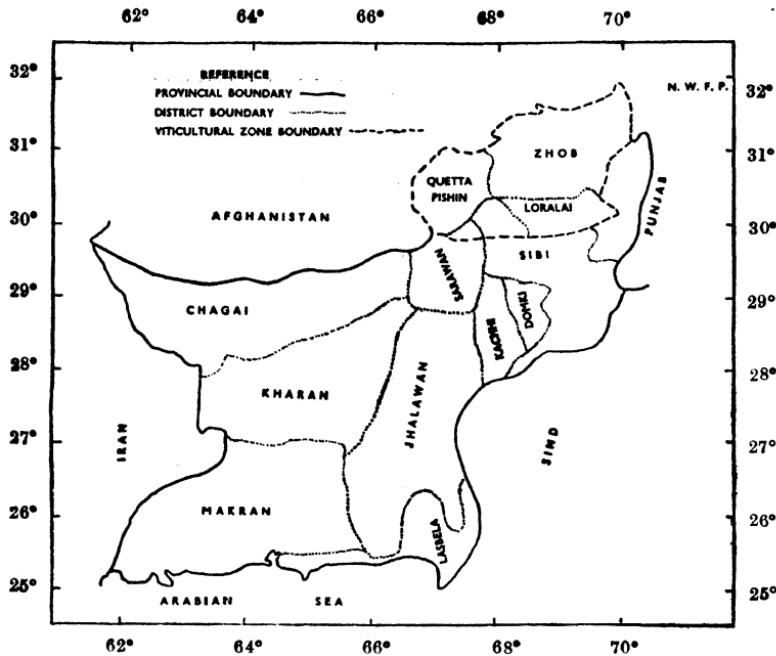


FIG. 1. Viticultural zone in Baluchistan

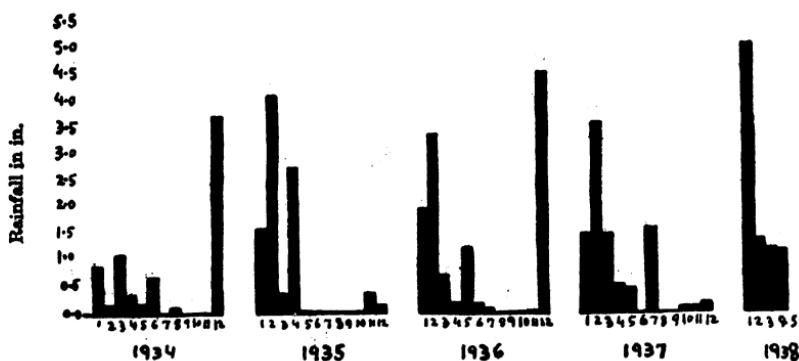
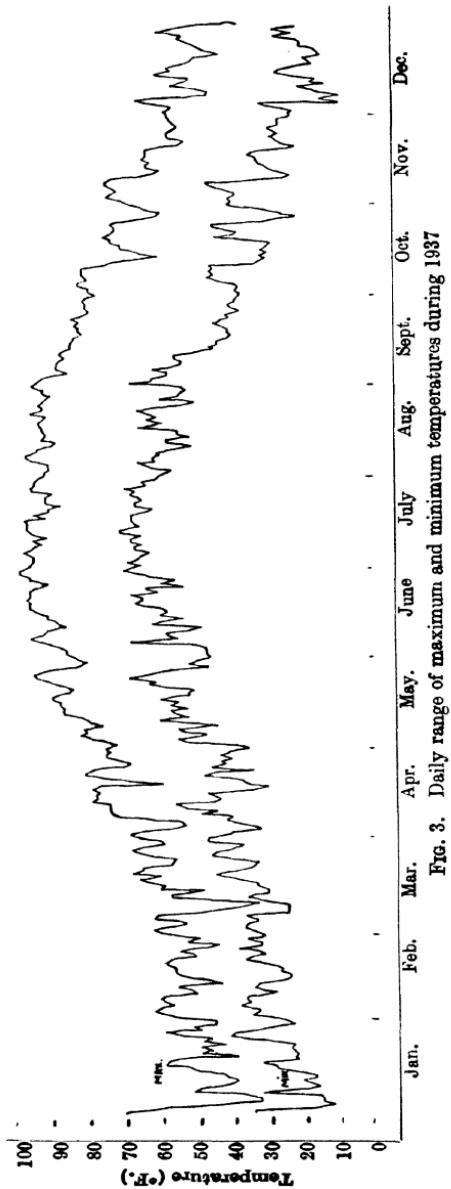


FIG. 2. Relative rainfall and its distribution during 1934-37



GRAPE-GROWING IN BALUCHISTAN

The soil is alkaline in reaction with a pH ranging from 8.1 to 8.6. Total water-soluble salts are about 0.09 per cent, an appreciable amount of which is present either in the form of sulphate of soda or bicarbonate of soda. Chemical and mechanical analyses of the soil made by the Imperial Agricultural Chemist are presented below.

	Clay per cent	Silt per cent	Sand per cent	Total N per cent	Lime (CaO) per cent	Total phosphoric acid (P ₂ O ₅) per cent	Total potash per cent	Available phosphoric acid (P ₂ O ₅) per cent	Available potash per cent
Surface crust (unmanured land)	9.2	34.2	56.4	0.121	11.77	0.18	0.81	0.01	0.028
Soil from 1 ft. deep (unmanured)	12.6	34.2	53.2	0.044	11.49	0.14	0.77	0.003	0.018
Orchard soil . . .	13.5	39.5	49.0	0.065	10.01	0.19	0.77	0.015	0.105

A hard black soil (*siah zamin*) is preferred for *Spin-kishmish*, a hard reddish soil (*sra* or *sur-khak*) is liked for *Haita* and a sandy soil containing gravel (*shaghana* or *subima*) is considered best for all other varieties.

A large variety of grapes are cultivated in Baluchistan. Some 18 varieties have been recorded and these are:—*Haita*, *Spin-kishmish*, *Tor*, *Sahibi*, *Hussaini*, *Srakishmish*, *Sheikh-ali*, *Kalamak*, *Spin-lal*, *Tandon*, *Kudak*, *Khalchini*, *Askari*, *Khairi-ghulaman* (*Kahaa-i-ghulaman*), *Shandao-khani*, *Kala*, *Khalili*, and *Sra-lal*. All these varieties have been briefly described in this paper. In addition to the above varieties, Buller [1907] mentions *Lal-yakdana*, *Amiri*, *Fakri* and *Raocha* in Baluchistan gazetteers. Neither of the first three varieties has been found growing in Baluchistan. *Raocha* and *Khalchini* are different names of the same vine. Early-picked grapes from the same vine are called *Khalchini*, while late-picked grapes are termed *Raocha*. The *Khalchini* described in this paper is the same as Buller's *Raocha*, but the so-called *Khalchini* mentioned by Buller as 'of light purple colour with a large seed' is not met with in Baluchistan.

Amongst the grapes cultivated in Baluchistan, *Haita*, *Spin-kishmish*, *Sahibi*, *Tor* and *Hussaini* are grown on commercial scale. The first two varieties are the only ones generally exported to other parts of India and the others are mainly grown for local consumption. According to the recent survey, the total area under grapes in Baluchistan is 2,429 acres and it is estimated that the average yield per vine is between 14 and 20 lb. The relative proportion in which these grape-vines are grown in Baluchistan and their distribution in different districts is given in Fig. 4.

Grapes are grown in Baluchistan for dessert use only. *Sahibi*, *Haita*, *Spin-kishmish* and *Sra-lal* are all dessert grapes of very high quality. In fact, as compared with the *vinifera* varieties of grape-vines imported from the United States of America, which are being grown at the Fruit Experiment Station at Quetta, it is considered that the Baluchistan varieties of grapes mentioned above are of real outstanding merit. Raisins are seldom made in Baluchistan, although several varieties, such as *Spin-kishmish*, *Haita*, *Shandao-khani*, etc. are very suitable for drying and are used for this purpose in Karidhar (Afghanistan). *Tandon* is considered to be suitable for extracting juice.

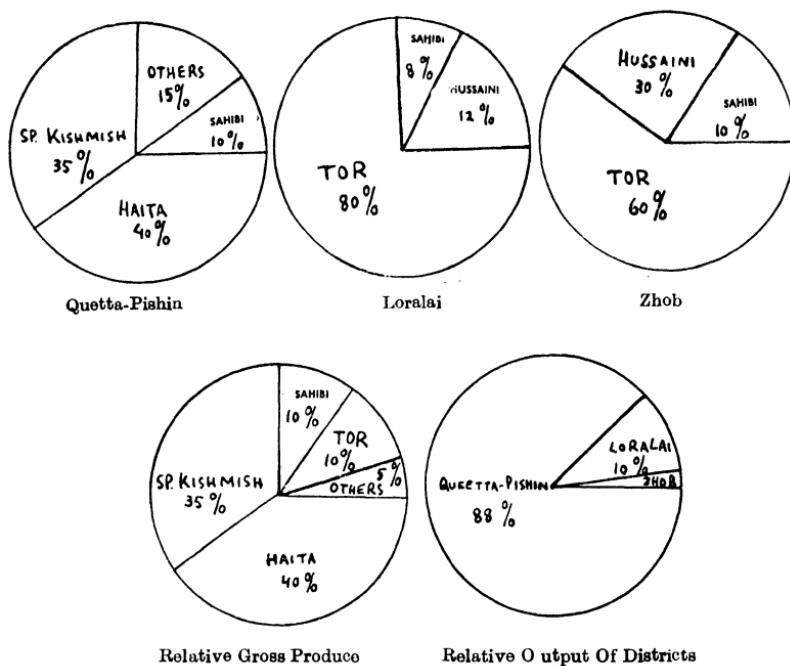


FIG. 4. Varieties of grape-vines grown in Baluchistan and their distribution in different districts

All the Baluchistan varieties of grapes belong to the species *Vitis vinifera* (Ampelidaceae). Flowers are identical in all cases, the only difference being in the shape of the ovary, which corresponds in shape with the ripe berries of different varieties, e.g. it is round in *Tundan*, oval in the case of *Sahibi* and *Khairi-Ghulaman*. Parthenocarpy occurs in the case of seedless varieties, viz. *Spin-kishmish*, *Sra-kishmish*, *Khalchini*, *Khalili* and *Askari*.

A brief note on the grape-vines of Baluchistan and local methods of their cultivation is given below.

LAYOUT OF A VINEYARD

Vineyards differ in their design from place to place according to the site and location of irrigation channels (*karezes*) but there are certain principles, which are generally observed in their layout. Vines are planted 5-8 ft. apart in trenches, which are about 2½ ft. wide and 2-3 ft. deep. Trenches are dug out originally to a depth of 2-3 ft. about 20 ft. apart and run parallel to each other. The earth removed from the trenches is heaped up in-between them along their edges, thus

forming a series of *bunds* (mounds). As the vines grow, more earth is dug out from the trenches and put on these *bunds*, so that in course of time, they become 6-7 ft. deep altogether. The length of trenches varies from vineyard to vineyard, according to the number of vines to be planted. Ordinarily they are about 48 ft. long, are of uniform dimensions and are always laid out east to west. About six or more of such trenches (*joa*) are connected by another trench (*samani*) which runs at right angles to them. This set of trenches forms a plot (*takhta*). A vineyard comprises of a number of such plots which are connected together by irrigation channels. Every vineyard has a definite plan and, unlike local orchards, there is a uniformity in their layout. Vines are invariably planted on the northern side of the *bund* in the case of small trenches (*joa*) and on the eastern side in the case of long trenches (*samani*), with a view to protecting them against the heat of the sun at noon.

Owing to the frequency and intensity of cold winds in winter, and hot and dry winds in summer, wind-breaks are a common feature of local vineyards. At Quetta and Kirani, however, the growers are not very particular about it. At other localities, every vineyard is usually girdled with a mud-wall 6-8 ft. high, with or without a fringe of dried camel-thorn at the top. Fig. 5 illustrates a general layout of vineyards in Baluchistan.

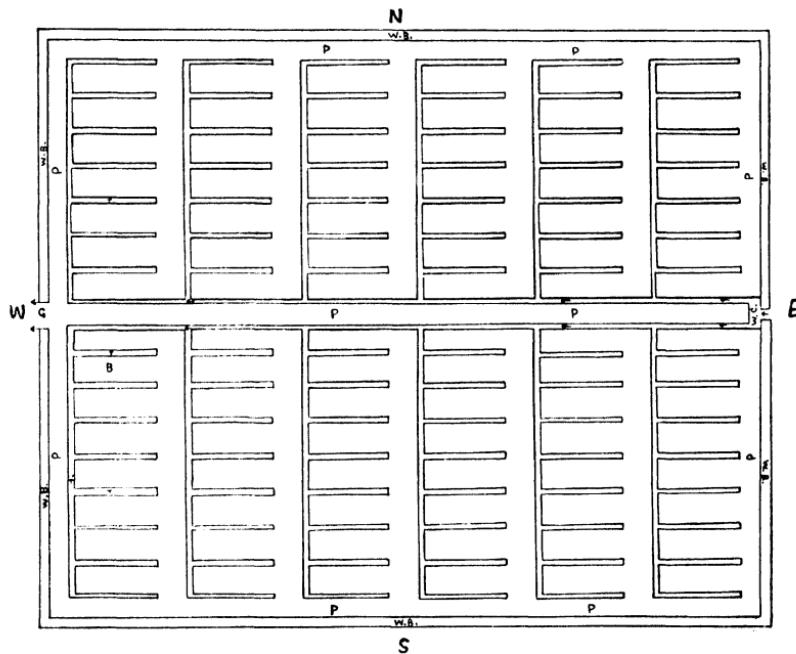


FIG. 5. Diagrammatic sketch of a typical vineyard (scale 1 inch = 100 feet). G—Gate, W.B.—Wind-break, P—Path, T and T'—Trenches in which the vines are planted, W.C.—Water channel.

PROPAGATION

Vines in Baluchistan are always propagated from cuttings. Usually ripe canes with six to eight nodes are selected and three such cuttings are planted side by side in a square pit (*ghaocha*) 2½-3 ft. deep and 6-8 ft. apart in trenches. Care is taken that only two joints of each cutting are allowed to remain exposed above-ground. Out of the three cuttings the one that does best is retained, and the rest are dug out, and if found fairly good, are used to fill up gaps elsewhere. One-year-old rooted vines known as *doganas* when transplanted are not considered to be so strong and thrifty as the ones which are not disturbed from their original places of planting and, consequently, no grape-vine nurseries are maintained. A system of layering is sometimes practised but it is not very common.

PRUNING

Pruning (*takhburi*) in Baluchistan is generally done very late in winter to prevent vines from being damaged by frost. In March of the second year, that is, one year after the cuttings have been planted in trenches, vines are pruned back to one shoot on which two to four nodes are retained and the top is inserted in a hole in the side of the trench to protect it from sun and wind. In March of the third year, two strong side canes are selected and headed back to three nodes to form two arms and the main stock is pruned back to about five nodes. The vines thus trained now possess a main trunk about one foot high with three arms, the tops of which are again inserted in the side of trenches. At the end of the fourth growing season each of the spurs of the last winter pruning produce one, two or more canes from which spurs are selected. Care is taken to space them as evenly as possible and not more than two buds are kept on each spur. In subsequent years pruning is done as before in March and the same method of pruning is followed. In addition to the above, dead branches and spurs (*khushka*) are removed in April and water sprouts (*kharlao*) which may appear on the trunk are also cut off. A certain amount of thinning of leaves and twigs (*kharberg*) is practised to allow proper aeration around bunches of grapes.

When vines are trained in trenches (*joa-tak*), they resemble in the framework of their trunks and arms to a 'bush form' and in their spread and training to an 'espalier' with the exception that there is no regular pairing of arms (*las*), as vines are not trained on any trellis but allowed to spread out on tall inclined mounds of earth along the trenches which offer them support and shelter from dry and cold winds as well as sun-scald. In the case of vines, trained on trees or arbor (*sawarat-tak*), the trunk is formed about three to five feet high, from which long branches are given the arrangement and direction best adapted to cover the space. When some of the vineyards become unthrifty, the trenches are sometimes filled up with earth and the vines, thus kept above the ground, are more or less trained in the 'bush form'. This filling up of trenches with earth is said to rejuvenate the vines, which is apparently due to the development of additional root-system.

Secateurs are neither liked nor used for pruning. Small steel saws of the size of an ordinary knife, which sometimes can be folded, are generally employed for this purpose. These are said to be manufactured in Kandhar (Afghanistan) from waste iron bands used in packing. For pruning dead arms, larger saws are used. Local pruners work very well with these tools, and lay much emphasis on pruning in one stroke.

MANURING

Farmyard manure at the rate of about four pounds per vine is applied after every third or fourth year. A small pit about one foot deep is dug out round the collar of the vine and is filled in with well-rotted farmyard manure, and covered over with earth. Care is taken not to use horse, sheep, goat or camel dung which is considered to be injurious to vines and is said to cause scorching of foliage.

IRRIGATION

The sources of water supply are *karezes*, artesian wells and streams. The main source of water supply, however, is from the numerous *karezes* in the province. The *karez* is a very ancient method of artificial irrigation indigenous to the locality. In its nature and mode of action, it is only a sub-soil drain. In both cases, the object is to bring water which lies underground to the surface, the only difference being that in the one case, it is desired to obtain the use, and in the other, to get rid of the water. Irrigation of vines is practised with care. After planting and during the months of June and July, the cuttings are watered regularly at intervals of 10 days. Later on, vines are irrigated after an interval of 18 days or so, and this practice is continued till the end of September, when irrigation is completely suspended. In January, two or three irrigations are given. This watering is reckoned very important for the vines and is called *yakh-ab* (cold water). During flowering (in the month of April) and when the grapes approach maturity, irrigation is invariably withheld. There is a general consensus of opinion amongst growers that watering during these periods is detrimental to vines. When irrigated during flowering, the fruit does not set well, many flowers may drop off and, as a result, there may be a poor crop. When irrigated during the ripening of berries, it leads to the deterioration of grapes, which lose their sweetness and become watery. Such grapes do not travel well and are susceptible to diseases and pests. During summer, irrigation at night is preferred to day irrigation, though this is not practically followed, as the *karez* water is used continuously day and night and every grower has his allotted hours during which he can make use of it.

Hoeing is done once a year in early spring. After irrigation, when the beds of trenches come into condition, the soil is hoed with spades.

PICKING AND PACKING

During the fruiting season, temporary labour is engaged for picking. A loose bag tied around the waist of a picker is generally used to hold grapes. After the grapes have been picked, they are brought to a packing shed, where each bunch is subjected to a scrutiny. Mildewed and unhealthy bunches are condemned and all bruised berries are removed with a pair of fine scissors. Grapes are then packed in special baskets made from pomegranate suckers and tamarix twigs in Kandhar and cost about five annas a pair. Paddy straw and certain weeds are used in packing. Packing is done with great care, and there are certain labourers who have specialized in this art. Round holes are dug out in the ground to hold baskets while packing. Grapes are packed in four to five layers, and a basket ordinarily holds 32-36 lb.

TRANSPORT

Donkeys, camels, carts, and motor trucks are used for transport of grapes. Baskets (*kavaras*) are especially designed to suit transport by donkeys and camels. Baskets of grapes are either brought to local markets for sale or are sent to

different parts of India mostly in cold storage vans. Two types of cold storage vane are used in the Quetta division, namely E. V. R. and E. V. N. vans. In the E. V. R. type, ice is loaded from outside, whereas in the E. V. N. vans, it is loaded from inside. Each van has a loading capacity of about 4 tons and ordinarily accommodates about 226 *kavaras*. A special fruit express is run daily by the North Western Railway during the fruiting season. Sixteen cold storage vans are loaded daily at Chaman with Kandhar grapes, and five cold storage vans are loaded daily from other stations in the Quetta division.

GRAZING OF SHEEP ON VINE FOLIAGE

It is a common practice in certain localities to graze sheep on vine foliage at the approach of autumn. The scarcity of fodder has probably led to this practice. As the grazing is done just a week or so before the foliage takes autumn colourations and would otherwise naturally drop off in two or three weeks, it is doubtful if any material damage is done to vines by this practice.

DISEASES AND PESTS

The following diseases and pests have been recorded on grape-vines in Baluchistan.

Diseases

Powdery mildew (*Oidium* sp.) ; Leaf-spot (*Asperisporium* sp. nov.) ; Grey rot (*Botrytis vulgaris* Fr.) ; Storage-rot (*Rhizopus nigricans* Ehr.) ; Blue mould (*Penicillium* spp.) and Stem-canker (*Sphaeropsis* and *Phoma* spp.)

Pests

The common wasps (*Vespa orientalis* Linn., *Vespa germanica* F., *Polistes gallica* Linn. and *Polistes hebraeus* F.) ; the Sphingid moths (*Theretra alecto* Linn., *Celerio lineata* F. and *Herse convolvuli* Linn.) ; the Grape leaf-hopper (*Empoasca decipiens* Paoli) and *Plagiodera versicolora* Laich.

DESCRIPTION OF VARIETIES

1. *Haita*.—Vigorous, hardy, very productive, fairly resistant to diseases and pests.

Trunk medium ; bark loose, shreddy, peeling off in larger and broader strips than in *Spin-kishmish*. One-year-old canes thick, hard, reddish, bent ; internodes 4-12 cm. long, 0.73-1.18 cm. thick in calibre, circular in cross-section ; nodes thickened, 0.97-1.37 cm. thick, more or less round, slightly more reddish than internodes ; diaphragm present, about 0.2 cm. thick. Eyes medium to large, round, prominent, woolly, deep red in colour ; growing shoots thin, rough, downy, yellowish green in colour ; tendrils medium thick, intermittent, pale-green, bifurcate.

Leaves large, roundish, thick ; upper surface dark green, glossy, comparatively rugose ; lower surface pale green, downy, five-lobed ; terminal lobe obtuse ; petiolar sinus deep, narrow, tending to be closed ; basal sinus shallow, narrow ; lateral sinus medium, narrow ; margin dentate ; teeth medium, variable in size.

Fruit late, ripens August to October ; bunches large, conical to cylindrical, (12-16 in. long) single or double shouldered, fairly compact, 16-48 oz. in weight ; comparatively thick, lignified ; pedicels 1.4 cm. long, thin, warted ; brush greenish yellow. Berries pale green, oval to oblong-oval, large, average $3\cdot4 \times 2\cdot0$ cm., six berries to an ounce ; skin thin, tough, yellowish, with very slight greenish tinge ; pulp tough, uniform, greenish, translucent, juicy ; seeds 1-2, large, broad, light brown to brown with thick yellowish beaks. Taste sweet, keeps well. Very good dessert grapes. Raisins prepared in Kandhar called *munakka* and *abjosh*. Bunches

are treated with a boiling solution of lime and carbonate of soda (*iskhar*) prior to sun-drying in the case of *abjosh*, while in the case of *munakka* grapes are simply sun-dried.

2. *Spin-kishmish*.—Fairly vigorous, very productive, comparatively resistant to diseases and pests.

Trunk medium ; bark dark grey, shreddy, peeling off in thin long strips ; one-year-old canes pinkish white, long, sinuous ; internodes 0·65-1 cm. thick in diameter, 6-12 cm. long ; nodes thick, more or less round, reddish ; eyes large, round, oppressed, red, woolly ; growing shoots thin, smooth, glabrous, straight, greenish white ; tendrils medium thick, pinkish green, bifurcate.

Leaves large, roundish, thick ; upper surface medium, green, glossy ; lower surface pale green, downy ; five-lobed, terminal lobe acuminate ; petiolar sinus deep, narrow ; basal sinus very shallow and narrow ; lateral sinus medium deep and narrow. Margin crenate, apical teeth of lobes sharp, prominent, others shallow, wide.

Fruit late, ripens August to October. Bunch large or medium, weighing 14 to 36 oz., cylindro-conical, tapering, regular, shouldered, compact ; peduncle 8-12 in. long, lignified ; pedicels medium, warted ; brush medium, greenish yellow. Berries small, roundish, oblong, average 1·55×1·22 cm., uniform, yellowish green to pale yellow ; 24 berries to an ounce ; skin thin, hard, adherent, yellowish green. Flesh transparent soft, yellowish, juicy, clear, very sweet ; seedless, very good dessert grapes, keep very well, dried in Kandhar to form raisins which are sold in India under the popular name of ' *kishmish*'.

3. *Tor*.—Most vigorous, hardy, very productive, fairly resistant to diseases and pests. Trunk large ; bark ashy grey, loose, shreddy, peeling off in long strips. One-year-old canes long, hard, sinuous red ; internodes 5-13 cm. long, rough, ribbed, round or slightly flattened, 0·67-1·09 cm. thick, nodes 1·1-1·8 cm. thick. Eyes medium, obtuse, not very prominent, woolly, red. Diaphragm thick (0·3-0·4 cm.). Tendrils thick (0·3-0·5 cm.), reddish brown, lignified, bi- or tri-furcate ; growing shoots thin, rough, glabrous, straight or slightly bent, green.

Leaves medium, roundish, thin ; upper surface light green, glossy ; lower surface pale green, downy ; five-lobed, terminal lobe slightly obtuse ; petiolar sinus deep, closed ; basal sinus medium ; lateral sinus deep, round, closed. Margin crenate, teeth shallow, wide.

Fruit mid-season, ripens mid-August, bunches large, weighing 14-48 oz., cylindrical below, conical above, single or double shouldered, very compact, berries often bruising by contact with each other ; peduncle thick, lignified, 8-12 in. long ; pedicels warted, 1·4 cm. long, reddish ; brush pink, fairly large. Berries globose, average 1·98×1·90 cm. ; seven berries to an ounce, dark purple ; skin reddish, very thick and tough, can be easily peeled off. Pulp yellowish, tough, vinous, taste sourish sweet. Seeds 1-4, fairly large, light brown to brown, with thick, short reddish beaks ; dessert grapes for local consumption ; do not keep well, unsuitable for export.

4. *Sahibi*.—Fairly vigorous, tender, not very productive, fairly resistant to diseases and pests. Trunk medium, bark ashy grey ; one-year-old canes long, redish, 6-14 cm. long, 0·68-1·39 cm. thick ; nodes slightly thicker than internodes, 0·83-1·6 cm. in diameter, more or less round, red ; eyes large, rounded, prominent, woolly, dark red ; growing shoots thin, smooth, glabrous or slightly downy, curved, yellowish pink. Tendrils numerous, intermittent, long, thick, bifurcate.

Leaves large, roundish, thick ; upper surface bluish green, glossy ; lower surface green, glabrous, veins slightly downy ; five-lobed, terminal lobe obtuse, petiolar sinus

deep, medium ; basal sinus deep, medium ; lateral sinus deep, narrow, overlapping ; margin more or less serrate, teeth n. medium.

Fruit mid-season, ripens early August, bunch medium to large, 16-32 oz. in weight, conical, shouldered, fairly compact ; peduncle fairly thick, lignified ; pedicels 8 mm. long, slightly warted ; berries oval, average $2\cdot2 \times 1\cdot9$ cm., pink to bluish yellow with fine ashy bloom ; seven berries to an ounce ; skin thin and very tender, yellowish with red pigments impregnated, adherent with the pulp. Pulp yellowish, translucent, soft, melting, juicy, clear, sweet ; seeds 1-3, medium, brown with blunt reddish tips. Excellent dessert grapes for local market ; do not keep well. Unsuitable for export.

5. *Hussaini*.—Fairly vigorous, hardy, productive, fairly resistant to diseases and pests. Trunk medium, bark loose, shreddy, one-year-old canes long, thick, reddish ; nodes enlarged, buds thick, obtuse, smooth ; internodes long, growing shoots pale green, ribbed, downy ; tendrils intermittent, slender, smooth, bifurcate.

Leaves large, roundish, thick, upper surface dark green, glossy, smooth ; lower surface pale green, slightly downy ; five-lobed, lobes obsolete in many cases ; petiolar sinus shallow, wide open ; other sinuses obsolete or very shallow and open ; petiole reddish.

Fruit mid-season ; bunches small, short, irregular, loose, 12-20 oz. in weight. Peduncle slender, weak ; pedicels long (1.3 cm.), warted ; brush yellow, large. Berries green or pale green, large, long, oblong, slightly narrowed in the centre ; average $3\cdot1 \times 1\cdot8$ cm. Skin soft, yellowish green ; pulp greenish yellow, seeds 1-3, light brown with yellowish beaks ; resembles *Haita* when fully ripe. Fairly sweet dessert grapes, not very suitable for export.

6. *Sheikh Ali*.—Vigorous, not very productive, susceptible to diseases and pests. Trunk thick ; bark loose, shreddy, peeling off in fairly long strips. Ripe canes reddish, slightly ribbed, thick ; internodes 7-15 cm. long, 0.9-1.5 cm. thick ; nodes very thick, round ; diaphragm present ; eyes prominent, thick, broadly acute, very slightly woolly ; growing shoots reddish, thin, ribbed, slightly pubescent ; tendrils few, smooth, thick, pale green, intermittent, bifurcate.

Leaves small, roundish, medium ; upper surface medium green, glossy ; lower surface light green, smooth, veins downy ; five-lobed ; terminal lobe obtuse ; petiolar sinus medium, basal sinus n. medium wide, lateral sinus deep, medium, margin dentate, teeth shallow, medium.

Fruit early, bunch large, 12-35 oz. in weight, fairly compact, broadly tapering, shouldered ; pedicels thick, slightly warted ; berries large, round, glossy, pale green ; average $2\cdot3 \times 2\cdot1$ cm. ; eight berries to an ounce ; skin tender, tough, adherent ; flesh pale green, translucent, tough. Taste not very sweet, rather sour ; seeds large, 1-4, brownish with yellow tips. Keeping quality poor. Dessert grapes for local markets.

7. *Khal Chini*.—Medium vines, not very vigorous, fairly productive, resistant to diseases and pests.

Trunk medium, slender ; bark loose, shreddy. Ripe canes reddish, brittle, sinuous, diaphragm present ; internodes 5-11 cm. long, 0.58-1.22 cm. thick, flattened or round ; nodes slightly thicker, round ; growing shoots reddish green, slightly downy, tendrils numerous, intermittent, slender, bifurcate.

Leaves large, thick ; upper surface dark green, glossy, smooth ; lower surface pale green, hairy, five to seven lobed. Terminal lobe, broad, obtuse ; petiolar sinus shallow, wide, open ; 'extrabasal' sinus medium ; basal sinus deep, roundish ; lateral sinus, deep, narrow, overlapping, margin more or less crenate ; teeth shallow, wide,

Fruit earliest, ripens in July, bunches small, short, conical, 5-14 oz. in weight, peduncle thin, green or reddish green, fragile, 5-8 inches long. Pedicels 1 cm. thin, warded, brush medium, pale green. Berries very small, round oval, average $1\cdot59 \times 1\cdot28$ cm., green or pale green, 24 berries to an ounce. Skin thin, tender, adherent; flesh pale green, translucent, insipid, seedless, 1-4 abortive green notched seeds; dessert grapes of poor quality, valued for their early ripening.

8. *Kuddak*.—Vigorous, good bearer, fairly resistant to diseases and pests.

Trunk fairly thick, bark ashy gray, slightly adherent, shreddy; ripe canes pinkish white, ribbed, straight or slightly bent; internodes 6-12 cm. long, circular in cross-section; nodes thick, slightly more reddish than the internodes, diaphragm present; eyes large, prominent, obtuse, woolly, tendrils pale green, intermittent, bifurcate.

Leaves medium, roundish, medium thick; upper surface glossy, dark green, smooth; lower surface pale green, hairy, five-lobed, terminal lobe obtuse; petiolar sinus, medium, wide, open; basal sinus very shallow, tending to be obsolete; lateral sinus deep, narrow, at times overlapping; margin dentate, teeth medium, wide.

Fruit late, ripens in September, bunches medium, 10-16 oz. in weight, loose cylindrical; peduncle thick, fairly lignified, yellowish white; pedicels 1-1.5 cm. long, thick, warded; brush greenish yellow, thick, short. Berries round or asymmetrical globose, medium large, average $1\cdot5 \times 1\cdot8$ cm., eight to nine berries to an ounce; skin thin, tender, yellowish-white; flesh pale, juicy, sweet or slightly acidic. Seeds one or two, base and beak notched, beak pinkish yellow. Fairly good dessert grapes for local consumption, do not keep well.

9. *Sra Kishmish*.—Vines medium, tender, very productive, fairly susceptible to diseases and pests.

Trunk medium, straggling, bark ashy grey, shreddy, one-year-old canes thin, hard, reddish, ribbed, internodes 5-11 cm. long, 4-4.6-2 mm. thick. Nodes thick, slightly flattened; 6-6 \times 4-1.8-2 \times 6-3 mm. thick, deep red in colour; diaphragm present, 1.5 mm. thick; eyes small, pointed prominent, woolly, reddish in colour; growing shoots thin, rough, glabrous, slightly flattened, reddish green, tendrils thin, fragile, reddish green, bifurcate.

Leaves small, broadly palmate, thin; upper surface dark green, glossy, smooth; lower surface pale green, hairy; distinctly five-lobed; terminal lobe broadly acuminate; petiolar sinus deep, fairly wide, open; basal sinus deep, wide, open; lateral sinus deep, round overlapping; margin serrate; teeth deep, medium.

Fruit early August, bunches small, very compact, variable in shape, 12-18 oz. in weight, cylindrical or cylindro-conical, with or without shoulder; pedicel 8 mm. long, thin; berries, light purple, delicate, round to ovoid, average $1\cdot5 \times 1\cdot4$ cm.; 20 berries to an ounce. Skin thin and very tender, adherent, colour purplish; pulp pale white, soft, taste sweet or slightly acidic. Seedless (1-4 very minute, pale, abortive seeds), do not keep well. Dessert grapes for local market, highly esteemed by local people, reckoned very easily digestible and perfectly harmless if consumed in large quantities. Raisins (*artawae*) prepared in Kandhar from these grapes.

10. *Kalamak*.—Vigorous, fairly hardy, very productive, susceptible to diseases and pests.

Trunk medium; bark ashy grey, thick, adherent, does not peel off in long strips; one-year-old canes medium, thick, reddish white, ribbed; internodes 7-15 cm. long, 0.5-0.8 cm. thick, more or less circular in cross-section; nodes thickened, 0.7-1 cm. in diameter, diaphragm present, reddish in colour; eyes prominent, large, obtuse, slightly woolly, red in colour; growing shoots thin, smooth, glabrous

or slightly pubescent, pale green, tendrils medium, numerous, intermittent, bifurcate.

Leaves medium to large, roundish, thick; upper surface dark green, glossy smooth; lower surface light green, downy; lobing variable, indistinct in young leaves, larger leaves five-lobed; terminal lobe obtuse, petiolar sinus, medium, very wide, basal sinus medium, shallow; lateral sinus deep, closed, overlapping.

Fruit late, bunch cylindro-conical, loose, shouldered; pedicels 1 cm. long, warty; brush fairly large; berries broad oval, medium in size, average $2\cdot1 \times 1\cdot6$ cm., yellowish green to pale white, glossy, nine berries to an ounce. Skin thin and tough, yellowish; pulp soft, watery, greenish yellow, not very tasteful, seeds 1-3, medium, light brown, notched, with reddish tips. Dessert grapes of poor quality, do not keep well.

11. *Tandan*.—Very vigorous, heavy bearer, very susceptible to diseases and pests. Trunk large, stocky, bark adherent, rather shreddy.

One-year-old canes long, numerous, thick, pinkish white, bent; nodes enlarged; internodes long, eyes large, obtuse, pink, woolly; growing shoots pinkish green, ribbed, downy; tendrils medium thick, long, numerous, intermittent, smooth; bifurcate.

Leaves medium, roundish; upper surface dark green, glossy, smooth; lower surface pale green, hairy, five-lobed; terminal lobe obtuse; petiolar sinus deep, medium; basal sinus medium; lateral sinus deep, overlapping; margin dentate, teeth medium wide.

Fruit late, ripens in early September; bunch small, 7-8 in. long, 12-26 oz. in weight, loose, cylindrical or cylindro-conical; peduncle thin, lignified; pedicel about 8 mm. long, comparatively thick, warty; brush thick, pale. Berries globose round, large, average $2\cdot2 \times 2\cdot3$ cm.; five berries to an ounce; skin greenish yellow, thin and tough; pulp yellowish white, with a slight greenish tinge, meaty, watery, not very sweet, somewhat insipid; seeds 1-3, fairly large, distinctly notched, grayish brown with short thick yellowish bifid tips. Dessert grapes for local market, do not keep well. In Kandhar the juice is extracted and boiled and is afterwards kept for use as a relish.

12. *Spin Lal*.—Not very vigorous, very productive, susceptible to diseases and pests.

Trunk medium, bark loose, shreddy. One-year-old canes hard, pinkish white in colour, smooth, ribbed, internodes medium long. Nodes more or less thickened, round or very slightly flattened, slightly darker in colour than the internodes, diaphragm present, thick. Eyes obtuse, not pointed, more or less round, red, prominent, glabrous. Growing shoots thin, greenish white, smooth, ribbed, straight or slightly bent, glabrous or downy. Tendrils thick, pale, green, or pinkish, very few, intermittent, bifurcate.

Leaves medium, cordate, medium-thick; upper surface medium green, glossy; lower-surface pale green, downy, five-lobed; terminal lobe acute; petiolar sinus deep, medium, broad, open; basal sinus medium to deep, lateral sinus deep, wide. Margin dentate, teeth shallow, broad, acuminate.

Fruit mid-season; bunch medium to large, loose, broad, conical; peduncle medium; about 9 in. long, thick, pale green, lignified; pedicel thick, short, light green, warty; berries variable, large, rarely small, seedless resembling *Spin-kishmish*, round, average $2\cdot4 \times 2\cdot4$ cm., pale green to creamy yellow; brush short, pale green. Skin thin, pale, adherent; pulp pale white, juicy, sweet; seeds 1-4, notched, large, flattened, with short beaks; dessert grapes of good quality grown for local consumption, do not keep well.

13. *Askari*.—Vigorous, hardy, heavy bearer, fairly resistant to diseases and pests.

Trunk very large, medium ; bark loose, shreddy. Ripe canes long, numerous, reddish white ; shreddy, woolly, more or less ribbed ; nodes enlarged, thick ; buds reddish, prominent, slightly medium ; internodes 6-12 cm. long ; tendrils few, intermittent, pinkish green, slender, smooth, bifurcate.

Leaves medium to large, fairly thick, upper surface dark green, glossy, smooth ; lower surface pale green, hairy, five-lobed ; terminal lobe acute or acuminate, petiolar sinus deep, medium ; basal sinus shallow to deep, narrow ; lateral sinus medium, narrow.

Fruit late ; bunch medium, rather loose, cylindrical, irregular, shouldered ; peduncle pale green, fragile, medium, slender ; pedicel short, medium, slightly warted ; brush short, yellow ; berries small, resemble *Spin-kishmish*, delicate, oblong, slightly broader at the pedicel end, creamy yellow ; skin thin, tender, adherent with the pulp ; flesh pale white, translucent, soft, melting, juicy, clear, very sweet ; seeds absent or abortive, minute, soft, oblong, reddish, with pale slender beaks. Very fine dessert grapes grown on a limited scale in Baluchistan, do not keep well, unsuitable for export.

14. *Kala (siah)*.—Vigorous, hardy, poor bearer, fairly resistant to diseases and pests. Trunk medium, slender ; bark ashy gray, rather loose, shreddy ; one-year-old canes red, long, straight ; nodes not much thickened ; internodes long ; eyes large, round, very woolly ; tendrils abundant, red, smooth, slender, bifurcate.

Leaves small, roundish, thick ; upper surface glossy, medium, dark green, smooth ; lower surface pale green, downy, five-lobed, terminal lobe acute. Petiolar sinus medium deep and fairly wide ; basal sinus shallow, narrow, tending to be obsolete in some cases ; lateral sinus medium to deep, narrow or closed, overlapping.

Fruit early ; ripens in July, bunch small, irregular, loose ; peduncle pale green, fragile ; pedicels medium long, pale green, warted ; brush medium, pinkish violet. Berries small, oval, more or less uniform, almost black, average $1\cdot8 \times 1\cdot5$ cm. ; skin thick, tough, black, not very adherent, flesh tough, dirty white, 1-2 seeds, pinkish yellow with reddish beak ; dessert grapes of poor quality, exported on a very small scale. In Kandhar raisins made of these grapes are called ' *tori wishki*' (black *kishmish*).

15. *Khair-i-Ghulaman (Khaiah-i-Ghulaman)*.—Vigorous, fairly hardy, poor bearer, very resistant to diseases and pests, grown on a very limited scale in Baluchistan.

Trunk fairly thick ; bark ashy gray, shreddy ; one-year-old canes hard, red in colour, circular in cross-section ; internodes 3-12 cm. long, $0\cdot5-0\cdot9$ cm. thick in diameter, ribbed ; nodes more or less thickened, $0\cdot8-1$ cm. in diameter, of the same colour as internodes, diaphragm present ; eyes small, pointed, woolly, red, prominent, growing shoots thin, smooth, glabrous, straight or slightly curved, green to pale green, tendrils thick, long, pale green, intermittent, bifurcate.

Leaves medium, roundish, thin ; upper surface light green, glossy, smooth ; lower surface pale green, downy ; five-lobed, terminal lobe acute ; petiolar sinus medium, wide, open ; basal sinus deep, narrow ; lateral sinus deep, narrow ; margin dentate, teeth medium, shallow broad.

Fruit late ; bunch large, 14-24 oz. in weight, cylindrical or cylindro-conical, shouldered, medium, loose ; peduncle fragile, reddish green ; pedicels 1 cm. long, reddish green, warted. Berries large, oblong or oblong-oval, dark purple, average 3×2 cm., seven berries to an ounce ; brush large, $0\cdot5-0\cdot7$ cm. long, thick, violet in colour ; skin thick, tough, reddish violet ; flesh tough, sweet, juicy, dirty greenish yellow. Seeds 3-4, dark brown, notched base, thick, pale pink beaks, crest prominent. Good dessert grapes, keep fairly well, suitable for export.

16. *Shandao-Khani*.—Vigorous, hardy, productive, very resistant to diseases and pests, grown on a limited scale in Baluchistan.

Trunk medium, bark loose, shreddy. Ripe canes long, numerous, slender, pinkish white, smooth ; nodes flattened, internodes 5-9 cm. long ; growing shoots pale green, slightly ribbed, downy ; tendrils intermittent, few, medium thick, smooth, lignified, bifurcate.

Leaves large, roundish, medium thick ; upper surface medium green, glossy, smooth ; lower surface pale green, smooth or very slightly downy ; five-lobed, terminal lobe obtuse. Petiolar sinus obtuse, deep, wide, open ; basal sinus shallow to deep, narrow ; margin dentate, teeth shallow.

Fruit late ; bunches medium, short or long, slender, irregular, cylindrical, shouldered, loose ; peduncle long or short, medium thick, yellow ; pedicel fairly long, slender, very slightly warty ; brush short, pale. Berries small, oval, average $1\cdot9 \times 1\cdot1$ cm., variable, smaller at the lower end of the bunch, pale yellow ; skin thick, tender, adherent with the pulp. Flesh pale white, translucent, sweet, clear, juicy ; seedless. Excellent grapes for making raisins. Long fine *kishmish* imported from Kandhar is prepared from these grapes.

17. *Sra-Lal*.—Vigorous, hardy, very productive. Fairly resistant to diseases and pests ; rarely grown in Baluchistan.

Trunk large, medium ; bark loose, shreddy ; ripe canes pinkish white, long, thick, flattened. Nodes flattened ; internodes long, flattened ; growing shoots pinkish green or pale green, downy ; tendrils intermittent, medium thick, lignified, bifurcate.

Leaves medium large, roundish, fairly thick ; upper surface dark green, glossy ; lower surface pale green, downy ; five-lobed, terminal lobe obtuse ; petiolar sinus medium narrow ; basal sinus medium narrow ; lateral sinus medium ; margin more or less crenate ; teeth medium large. Fruit mid-season, bunch medium to large, loose, broad, cylindrical ; peduncle, medium large, thick, pale green, lignified ; pedicel thick, short, light green, warty ; brush short, pink ; berries large, round, variable, average $2\cdot5 \times 2\cdot2$ cm., dark red, skin tough, red, adherent ; pulp pale white, juicy, sweet ; seeds 1-4, notched, large flattened, pinkish, with red, broad, short beaks. Only a few vines are met with in Baluchistan. Good dessert grapes, keep well.

18. *Khalili*.—Vigorous, fairly hardy, good bearer, fairly resistant to diseases and pests.

Trunk thick ; bark shreddy ; ripe canes pinkish, bent ; nodes thickened, round, internodes long, circular in cross-section ; eyes small, acute, reddish, woolly ; tendrils thick, lignified, numerous, intermittent, simple or bifurcate.

Leaves small, thin ; upper surface medium green, glossy, smooth ; lower surface pale green, downy, three to five-lobed, terminal lobe acute. Petiolar sinus rather narrow, deep, open ; basal sinus very shallow, tending to be obsolete in some leaves, lateral sinus shallow, wide, open. Margin dentate ; teeth short, broad, or obtuse with minute apices.

Fruit early, bunches small, berries slightly bigger, and a bit longer than *Askari*, thinner at the lower end, more or less conical in shape, seedless or with 1-2 seeds, resembles the latter in details but is inferior in taste and ripens early ; dessert grapes, grown on a very limited scale in Baluchistan.

Fakhri and *Amiri*.—These are mentioned by Buller [1907] in *Quetta-Pishin District Gazetteers*, but have not been observed by the authors anywhere in Baluchistan. Buller's descriptions are quoted here for reference.

Fakhri.—A light green grape, long in shape and with a soft skin. A bunch weighs from $\frac{1}{2}$ to $\frac{1}{3}$ seer. Ripens in the last week of June and lasts for about 15 days. Is not common.

Amiri. A medium-sized, soft-skinned, green grape with a small indentation at end. Sweet to taste. Procurable during September and October. Very rare in the Quetta-Pishin district. A bunch weighs about half a seer.

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LOCAL SYSTEM OF PRUNING GRAPE-VINES IN BALUCHISTAN

PLATE I



FIG. 1. Unpruned vine

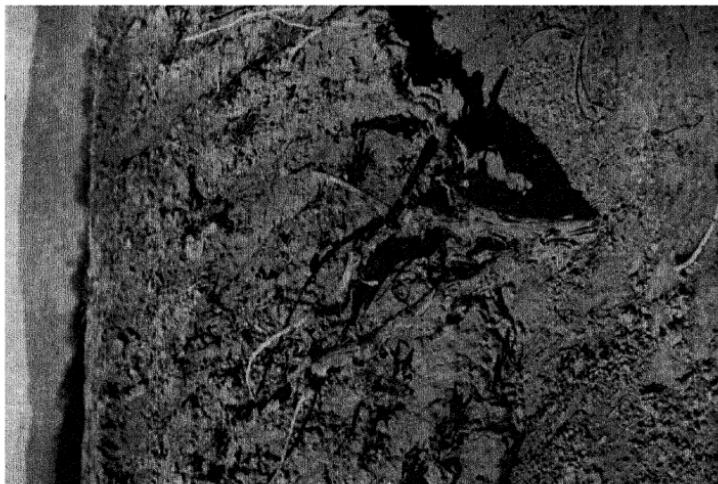
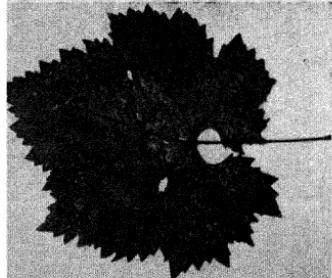


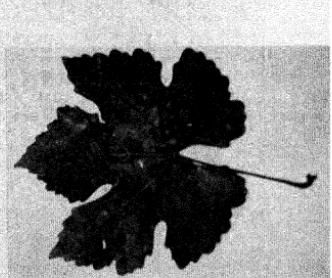
FIG. 2. Pruned vine

LEAVES OF DIFFERENT VARIETIES OF GRAPE-VINES
(TWELFTH LEAF OF FIRST Ripe CANE)

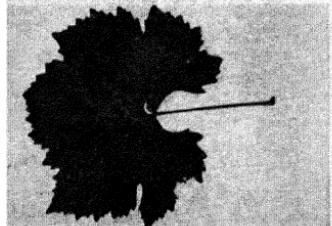
PLATE II



Spin-Kishmish



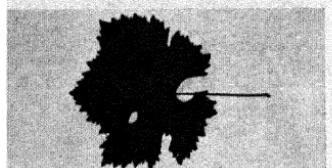
Khalchini



Haila



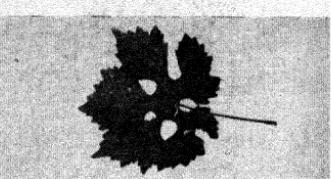
Sheikh Ali



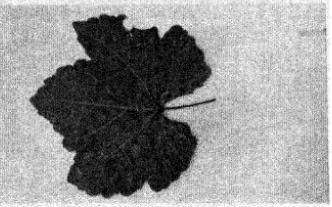
Tandom



Kudlak



Sra Kishmish

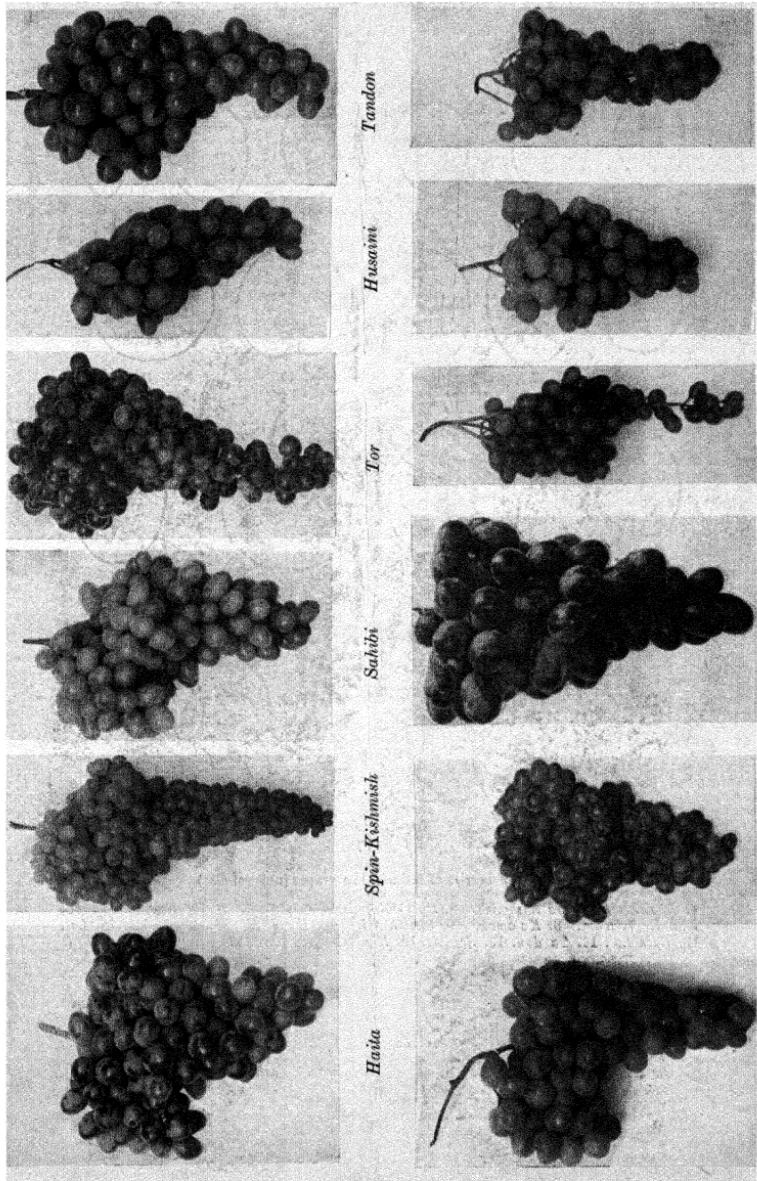


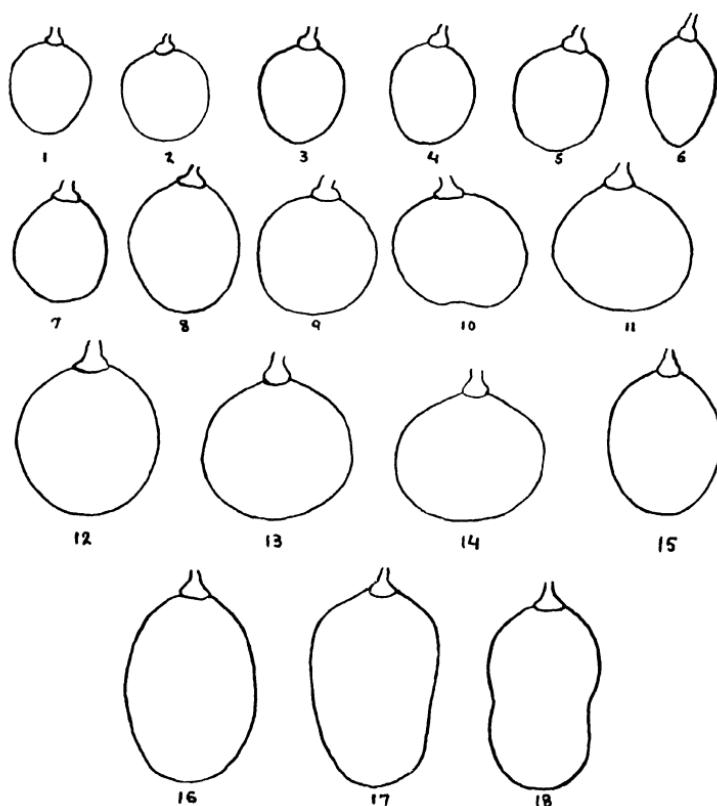
Askari



Tor

BUNCHES OF DIFFERENT VARIETIES OF BALUCHISTAN GRAPES



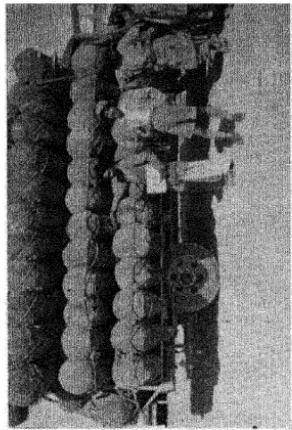


Shapes of berries of Baluchistan grapes (natural size)

1. *Khalchini*. 2. *Sra Kishmish*. 3. *Spin-Kishmish*. 4. *Azakari*. 5. *Khalili*. 6. *Shandao Khan*. 7. *Kalu*. 8. *Kalamak*. 9. *Sheikh Ali*. 10. *Kuddak*. 11. *Tor*. 12. *Sra Lal*. 13. *Spin Lal*. 14. *Tandan*. 15. *Sahibi*. 16. *Khair-i-Ghulaman*. 17. *Haita*. 18. *Hussaini*.

PACKING AND TRANSPORT OF GRAPES

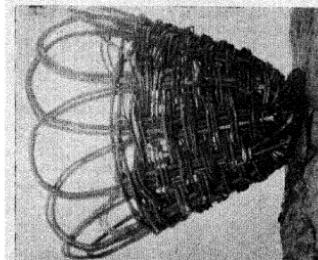
PLATE V



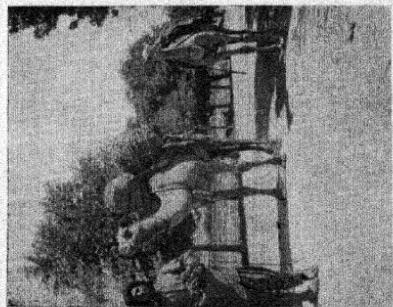
1. Empty *kavara*



2. Packed *kavara*



3. Motor Truck loaded with *kavaras*



4. Loaded donkeys
5. Loaded camels
6. Fruit vans



